

Revised per TAG vote on June 30th

Section R202 Definitions

Advanced Framed Ceiling. Advanced framing assumes full and even depth of insulation extending to the outside edge of the exterior walls.

Intermediate Framed Walls. Studs framed on 16 or 19.2 inch centers with double top plate and a single bottom plate. Corners and intersections of interior partitions to exterior walls shall use two or three studs assembled to allow a means to fully insulate the corner and the means to properly attach a hold-down device according to the manufacture's installation instructions. Headers shall meet the requirements of Table R502.5(1) for exterior walls for size and jack stud support. Where Table R502.5(1) specifies header materials that when assembled results in a depth less than the full depth of the thickness of the wall, the remaining void shall be fully insulated.

Part IV—Energy Conservation

CHAPTER 11 ENERGY EFFICIENCY

SECTION N1101 GENERAL

N1101.1 Scope. This chapter regulates the energy efficiency for the design and construction of buildings regulated by this code. Chapter 11 of this code shall be known as the “Washington State Residential Energy Code.” and may be cited as such; and will be referred to herein as “this code.”

Exception: Portions of the building envelope that do not enclose *conditioned space*.

N1101.1.1 Exempt Buildings: Buildings and structures or portions thereof meeting any of the following criteria shall be exempt from the building envelope requirements of Section N1102, but shall comply with all other requirements for building systems, lighting systems and water heating.

N1101.1.1.1: Buildings and structures or portions thereof whose peak design rate of energy usage is less than 3.4 Btu/h per ft² or 1.0 watt per ft² of floor area for space conditioning requirements.

N1101.1.1.2: Buildings and structures or portions thereof which are neither heated nor cooled.

N1101.1.1.3: Greenhouses isolated from any

conditioned space and not intended for occupancy.

N1101.1.2 Application to Existing Buildings: Additions, historic buildings, changes of occupancy or use and alterations or repairs shall comply with the requirements in the subsections below.

EXCEPTION: The building official may approve designs of alterations or repairs which do not fully conform with all of the requirements of this Code where in the opinion of the building official full compliance is physically impossible and/or economically impractical and:

1. The alteration or repair improves the energy efficiency of the building; or
2. The alteration or repair is energy efficient and is necessary for the health, safety, and welfare of the general public.

In no case shall building envelope requirements or mechanical system requirements be less than those requirements in effect at the time of the initial construction of the building.

N1101.1.2.1 Additions to Existing Buildings: Additions to existing buildings or structures may be made to such buildings or structures without making the entire building or structure comply, provided

that the new additions shall conform to the provisions of this Code.

EXCEPTION: New additions which do not fully comply with the requirements of this Code and which have a floor area which is less than 750 square feet shall be approved provided that improvements are made to the existing occupancy to compensate for any deficiencies in the new addition. Compliance shall be demonstrated

by either Simulated Performance Alternative according to Section 405 of the *International Energy Conservation Code* or the Total UA Alternative requirements in Section N1102.1.3. The nonconforming addition and upgraded existing occupancy shall have an energy budget or Target UA which is less than or equal to the unimproved existing building (minus any elements which are no longer part of the building envelope once the addition is added), with the addition designed to comply with this Code.

N1101.1.2.2: Historic Buildings: The building official may modify the specific requirements of this Code for historic buildings and require in lieu thereof alternate requirements which will result in improved energy efficiency. This modification may be allowed for those buildings which have been specifically designated as historically significant by the state or local governing body, or listed in The National Register of Historic Places or which have been determined to be eligible for listing.

N1101.1.2.3: Change of Occupancy or Use: Any Occupancy which is converted to meet the scoping requirements of this code in accordance to Section R101.2 shall be brought into full compliance with this Code.

N1101.1.2.4: Alterations and Repairs: All alterations and repairs to buildings or portions thereof originally constructed subject to the requirements of this Code shall conform to the provisions of this Code without exception. For all other existing buildings, initial tenant alterations shall comply with the new construction requirements of this Code. Other alterations and repairs may be made to existing buildings and moved buildings without making the entire building comply with all of the requirements of this Code for new buildings, provided the following requirements are met:

N1101.1.2.5: Building Envelope: The result of the alterations or repairs both:

1. Improves the energy efficiency of the building, and
2. Complies with the overall average thermal

transmittance values of the elements of the exterior building envelope in Table N1102.1.2 or the nominal R-values and glazing requirements of the reference case in Table N1102.1.

EXCEPTIONS: 1. Untested storm windows may be installed over existing glazing for an assumed U-factor of 0.90, however, where glass and sash are being replaced, glazing shall comply with the appropriate reference case in Tables N1102.1 and N1102.1.2.

2. Where the structural elements of the altered portions of roof/ceiling, wall or floor are not being replaced, these elements shall be deemed to comply with this Code if all existing framing cavities which are exposed during construction are filled to the full depth with batt insulation or insulation having an equivalent nominal R-value while, for roof/ceilings, maintaining the required space for ventilation. Existing walls and floors without framing cavities need not be insulated. Existing roofs shall be insulated to the requirements of this Code if:

- a. The roof is uninsulated or insulation is removed to the level of the sheathing, or
- b. All insulation in the roof/ceiling was previously installed exterior to the sheathing or nonexistent.

N1101.1.2.6: Building Mechanical Systems: Those parts of systems which are altered or replaced shall comply with Section N1103 of this Code.

N1101.1.2.7: Service Water Heating: Those parts of systems which are altered or replaced shall comply with Section N1103 of this Code.

N1101.1.3: Amendments By Local Government: Except as provided in RCW 19.27A.020(7), this Code shall be the maximum and minimum energy code for buildings meeting the scope of this code in each town, city and county.

N1101.2 Compliance. Compliance shall be demonstrated by either meeting the requirements of the *International Energy Conservation Code* or an above code program per section N1101.8 or by meeting the requirements of this chapter. Climate zones from Figure N1 101.2 or Table N1 101.2 shall be used in determining the applicable requirements from this chapter. Climate Zone 5 for Washington State shall include all counties not specifically designated in Climate Zone 6. Climate Zone 6 shall include: Adams, Chelan, Douglas, Ferry, Grant, Kittitas, Lincoln, Okanogan, Pend Oreille, Spokane, Stevens and Whitman counties.

N1101.2.1 Warm humid counties. Warm humid counties are identified in Table N1101.2 by an asterisk.

N1101.3 Identification. Materials, systems and *equipment* shall be identified in a manner that will allow a determination of compliance with the applicable provisions of this chapter.

N1101.4 Building thermal envelope insulation. An *R*-value identification *mark* shall be applied by the manufacturer to each piece of *building thermal envelope* insulation 12 inches (305 mm) or more wide. Alternately, the insulation installers shall provide a certification listing the type, manufacturer and *R*-value of insulation installed in each element of the *building thermal envelope*. For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness, settled thickness, settled *R*-value, installed density, coverage area and number of bags installed shall be listed on the certification. For sprayed polyurethane foam (SPF) insulation, the installed thickness of the area covered and *R*-value of installed thickness shall be listed on the certificate. The insulation installer shall sign, date and post the certificate in a conspicuous location on the job site.

N1101.4.1 Blown or sprayed roof/ceiling insulation. The thickness of blown in or sprayed roof/ceiling insulation (fiberglass or cellulose) shall be written in inches (mm) on markers that are installed at least one for every 300 ft² (28 m²) throughout the *attic* space. The markers shall be affixed to the trusses or joists and marked with the minimum initial installed thickness with numbers a minimum of 1 inch (25 mm) high. Each marker shall face the *attic* access opening. Spray polyurethane foam thickness and installed *R*-value shall be listed on the certificate provided by the insulation installer.

N1101.4.2 Insulation mark installation. Insulating materials shall be installed such that the manufacturer's *R*-value *mark* is readily observable upon inspection.

N1101.5 Fenestration product rating. *U*-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100 by an accredited, independent laboratory, and *labeled* and certified by the manufacturer. Products lacking such a *labeled U*-factor shall be assigned a default *U*-factor from Tables N1101.5(1) and N1 101.5(2). The solar heat gain coefficient (SHGC) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and *labeled* and certified by the manufacturer. Products lacking such a *labeled* SHGC shall be assigned a default SHGC from Table N1 101.5(3).

N1101.6 Insulation product rating. The thermal resistance (*R*-value) of insulation shall be determined in accordance with the CFR Title 16, Part 460, in units of h .ft².°F/Btu at a mean temperature of 75°F (24°C).

N1101.7 Installation. All materials, systems and *equipment* shall be installed in accordance with the manufacturer's installation instructions and the provisions of this code.

N1101.7.1 Protection of exposed foundation insulation. Insulation applied to the exterior of *basement* walls, crawlspace walls, and the perimeter of slab-on-grade floors shall have a rigid, opaque and weather-resistant protective covering to prevent the degradation of the insulation's thermal performance. The protective covering shall cover the exposed exterior insulation and extend a minimum of 6 inches (152 mm) below *grade*.

N1101.8 Above code programs. The *building official* or other authority having *jurisdiction* shall be permitted to deem a national, state or local energy efficiency program to exceed the energy efficiency required by this chapter. Buildings *approved* in writing by such an energy efficiency program shall be considered in compliance with this chapter.

N1 101.9 Certificate. A permanent certificate shall be posted on or in the electrical distribution panel. The certificate shall not cover or obstruct the visibility of the circuit directory *label*, service disconnect *label* or other required *labels*. The certificate shall be completed by the builder or registered *design professional*. The certificate shall list the predominant *R*-values of insulation installed in or on ceiling/roof, walls, foundation (slab, *basement wall*, crawlspace wall and/or floor) and ducts outside *conditioned spaces*; *U*-factors for fenestration; and the solar heat gain coefficient (SHGC) of fenestration. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list the types and efficiencies of heating, cooling and service water heating *equipment*. Where a gas-fired unvented room heater, electric furnace and/or baseboard electric heater is installed in the residence, the certificate shall list "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be listed for gas-fired unvented room heaters, electric furnaces or electric base board heaters. In addition to the types and efficiencies of the HVAC equipment forced air distribution systems shall list the design airflow, the available static pressure, the total effective duct length and the friction rate used in the duct design procedure for the installed equipment.

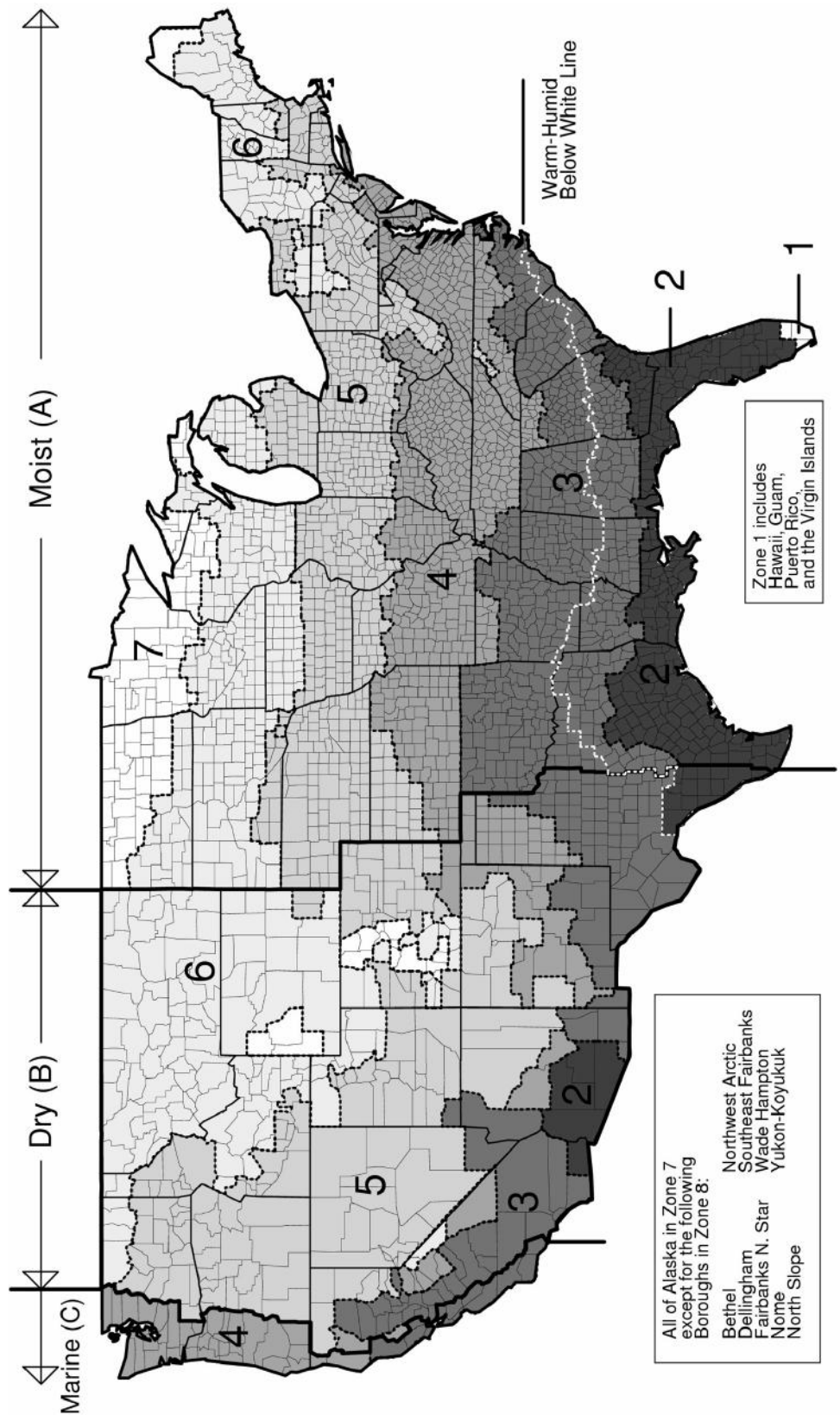


FIGURE N1101.2
CLIMATE ZONES

(continued)

LE N1101.2—continued
CLIMATE ZONES, MOISTURE REGIMES AND WARM-HUMID DESIGNATIONS BY STATE, COUNTY AND TERRITORY

Key:

A—Moist, B—Dry, C—Marine, Absence of moisture designation indicates moisture regime is irrelevant. Asterisk (*) indicates a warm-humid location.

	Washington	
	<u>6</u> B Adams	<u>5</u> C Wahkiakum
	<u>5</u> B Asotin	<u>5</u> B Walla Walla
	<u>5</u> B Benton	<u>5</u> C Whatcom
	<u>6</u> B Chelan	<u>6</u> B Whitman
		<u>5</u> B Yakima
	<u>5</u> C Clallam	
	<u>5</u> C Clark	
	<u>5</u> B Columbia	
	<u>5</u> C Cowlitz	
	<u>6</u> B Douglas	
	<u>6</u> B Ferry	
	<u>5</u> B Franklin	
	<u>5</u> B Garfield	
	<u>6</u> B Grant	
	<u>5</u> C Grays Harbor	
	<u>5</u> C Island	
	<u>5</u> C Jefferson	
	<u>5</u> C King	
	<u>5</u> C Kitsap	
	<u>6</u> B Kittitas	
	<u>5</u> B Klickitat	
	<u>5</u> C Lewis	
	<u>6</u> B Lincoln	
	<u>5</u> C Mason	
	<u>6</u> B Okanogan	
	<u>5</u> C Pacific	
	<u>6</u> B Pend Oreille	
	<u>5</u> C Pierce	
	<u>5</u> C San Juan	
	<u>5</u> C Skagit	
	<u>5</u> B Skamania	
	<u>5</u> C Snohomish	
	<u>6</u> B Spokane	
	<u>6</u> B Stevens	
	<u>5</u> C Thurston	

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CLIMATE ZONES, MOISTURE REGIMES AND WARM-HUMID DESIGNATIONS BY STATE, COUNTY AND TERRITORY

A—Moist, B—Dry, C—Marine, Absence of moisture designation indicates moisture regime is irrelevant. Asterisk (*) indicates a warm-humid location.

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TABLE N1101.5(1)

FRAME TYPE	SINGLE PANE	DOUBLE PANE	SKYLIGHT	
			Single	Double
Metal	1.2	0.8	2	1.3
Metal with thermal break	1.1	0.65	1.9	1.1
Nonmetal or metal clad	0.95	0.55	1.75	1.05
Glazed block	0.6			

DEFAULT DOOR U-FACTORS

DEFAULT DOOR <i>U</i> -FACTORS	DOOR TYPE
	<i>U</i> -FACTOR
Uninsulated metal	1.2
Insulated metal	0.6
Wood	0.5
Insulated, nonmetal edge, max 45% glazing, any glazing double pane	0.35

TABLE N1 1 01.5(3)

SINGLE GLAZED		DOUBLE GLAZED		GLAZED BLOCK
Clear	Tinted	Clear	Tinted	
0.8	0.7	0.7	0.6	0.6

SECTION N1102 BUILDING THERMAL ENVELOPE

N1102.1 Insulation and fenestration criteria. The *building thermal envelope* shall meet the requirements of Table N1 102. 1 based on the climate zone specified in Table N1 101. 2.

N1102.1.1 R-value computation. Insulation material used in layers, such as framing cavity insulation and insulating sheathing, shall be summed to compute the component R-value. The manufacturer's settled R-value shall be used for blown insulation. Computed R-values shall not include an R-value for other building materials or air films.

N1102.1.2 U-factor alternative. An assembly with a U-factor equal to or less than that specified in Table

N1 102. 1. 2 shall be permitted as an alternative to the R-value in Table N1102.1.

N1102.1.3 Total UA alternative. If the total *building thermal envelope* UA for the proposed building (sum of U-factor times assembly area) is less than or equal to the total UA resulting from using the U-factors in Table N1102.1.2, for the target building (multiplied by the same assembly area as in the proposed building), the building shall be considered in compliance with Table N1 102. 1. The UA calculation shall be done using Appendix R or a method approved by the building official consistent with the *ASHRAE Handbook of Fundamentals* and shall include the thermal bridging effects of framing materials. The SHGC requirements shall be met in addition to UA compliance.

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT^a

CLIMATE ZONE	FENESTRATION U-FACTOR _{n,o}	SKYLIGHT ^b U-FACTOR	GLAZED ^a FENESTRATION SHGC	ALL CEILING ^c R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE ^{k,s}	FLOOR R-VALUE	BASEMENT ^c WALL R-VALUE	SLAB ^d R-VALUE AND DEPTH	CRAWL SPACE ^{e,d} WALL R-VALUE
1	1.2	0.75	0.35 _j	30	13	3/4	13	0	0	0
2	0.65 ⁱ	0.75	0.35 _j	30	13	4/6	13	0	0	0
3	0.50 ⁱ	0.65	0.35 _{e,j}	30	13	5/8	19	5/13 ^f	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.34 _m	0.55	NR	49 or 38 ADV	21 or 13 + 5 _{hp}	15/19	30 ^g or 21+3.5	15/21	10, 2 ft	10/13
6	0.34 _m	0.55	NR	49 or 38 ADV	21 or 13 + 5 _h	15/19	30 ^g or 21+3.5	15/21	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	30 _g	10/13	10, 4 ft	10/13

a. R-values are minimums. U-factors and solar heat gain coefficient (SHGC) are maximums. R-19 batts compressed in to nominal 2.6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.

b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

c. The first R-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.

d. R-5 shall be added to the required slab edge R-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less, in zones 1 through 3 for heated slabs.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure N1 101.2 and Table N1 101.2.

g. Or insulation sufficient to fill the framing cavity, R-19 21 minimum plus R-3.5 continuous insulation.

h. "13 15+5" means R-13 15 cavity insulation plus R-5 insulated sheathing, continuous insulation. If structural sheathing covers 25% or less of the exterior, R-5 sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25% of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

i. For impact-rated fenestration complying with Section R301.2.1.2, the maximum U-factor shall be 0.75 in zone 2 and 0.65 in zone 3.

j. For impact-resistant fenestration complying with Section R301.2.1.2 of the *International Residential Code*, the maximum SHGC shall be 0.40.

k. The second R-value applies when more than half the insulation is on the interior.

l. Reserved

m. For door fenestration U-Factor shall be no greater than 0.20.

n. When the Total UA Alternative of Section N1102.1.3 is selected as the compliance method the target building shall assume a maximum of 15% glazed fenestration area as a ratio to the building floor area. If the requirements of Section N1102 can not be met the provisions of Section 405 of the IECC for Simulated Performance Alternate shall be permitted to be used. The maximum area of glazed fenestration allowed as a ratio of glazing area to the building floor area shall meet one of the following:

1. Glazed fenestration is limited to 15% maximum area when a U-factor of 0.34 is used, or

2. Glazed fenestration area can be increased to a maximum of 26% if a U-factor of 0.32 is used, or

3. Glazed fenestration area can be an unlimited area if a U-factor of 0.30 or better is used. Where intermediate wall framing is used a U-factor of 0.32 or better is permitted to be used in the allowed unlimited glazed area.

o. U-factor per Small Business Compliance Table N1101.5(4) is allowed for vertical glazed fenestration manufactured by companies meeting the small business classification requirements of the Washington State Dept. of Revenue.

p. A minimum of R-15 cavity insulation is permitted where the glazing area is equal to or less than 10% of the conditioned floor area.

q. Crawl space wall insulation is not required where the requirements for floor R-Values are met.

r. To the maximum extent possible, insulation shall extend over the full component area to the intended R-value.

s. Log and timber walls shall be permitted to be a minimum of 3.5 inches in cross section.

N1102.2 Specific insulation requirements.

N1102.2.1 Ceilings with attic spaces. When Section N1102.1 would require R-38 in the ceiling, R-30 shall be deemed to satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Similarly R-38 shall be deemed to satisfy the requirement for R-49 wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. This reduction shall not apply to the *U*-factor alternative approach in Section N1102.1.2 and the Total UA alternative in Section N1102.1.3.

N1102.2.2 Ceilings without attic spaces. Where Section N1102.1 would require insulation levels above R-30~~38~~ and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation the minimum required insulation for such roof/ceiling assemblies shall be R-30~~38~~. ~~This reduction of insulation from the requirements of Section 402.1.1 shall be limited to 500 square feet (46 m²) of ceiling area.~~ This reduction shall not apply to the *U*-factor alternative approach in Section N1 102.1.2 and the Total UA alternative in Section N1102.1.3.

N1102.2.3 Access hatches and doors. Access doors from *conditioned spaces* to unconditioned spaces (e.g., attics and crawl spaces) shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access shall be provided to all *equipment* which prevents damaging or compressing the insulation. A wood framed or equivalent baffle or retainer is required to be provided when loose fill insulation is installed, the purpose of which is to prevent the loose fill insulation from spilling into the living space when the *attic* access is opened and to provide a permanent means of maintaining the installed *R*-value of the loose fill insulation.

N1102.2.4 Mass walls. Mass walls, for the purposes of this chapter, shall be considered above-grade walls of concrete block, concrete, insulated concrete form (ICF), masonry cavity, brick (other than brick veneer), earth (adobe, compressed earth block, rammed earth) and solid timber/logs.

N1102.2.5 Steel-frame ceilings, walls and floors. Steel-frame ceilings, walls and floors shall meet the insulation requirements of Table N1 102.2.5 or shall meet the *U*-factor requirements in Table N1 102.1.2. The calculation of the *U*-factor for a steel-frame envelope assembly shall use a series-parallel path calculation method.

Exception: In climate zones 1 and 2, the continuous insulation requirements in Table N1 102.2.5 shall be permitted to be reduced to R-3 for steel frame wall assemblies with studs spaced at 24 inches (610mm) on center.

N1102.2.6 Floors. Floor insulation shall be installed to maintain permanent contact with the underside of the subfloor decking.

N1102.2.7 Basement walls. *Exterior walls* associated with conditioned basements shall be insulated from the top of the *basement wall* down to 10 feet (3048 mm) below *grade* or to the *basement* floor, whichever is less. Walls associated with unconditioned basements shall meet this requirement unless the floor overhead is insulated in accordance with Sections N1102.1 and N1 102.2.6.

N1102.2.8 Slab-on-grade floors. Slab-on-grade floors with a floor surface less than ~~42~~ 48 inches below *grade* shall be insulated in accordance with Table N1 102.1. The insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below *grade* shall be extended the distance provided in Table N1 102.1 by any combination of vertical insulation, insulation extending under the slab or insulation extending out from the building. Insulation extending away from the building shall be protected by pavement or by a minimum of 10 inches (254 mm) of soil. The top edge of the insulation installed between the *exterior wall* and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the *exterior wall*. Slab-edge insulation is not required in jurisdictions designated by the code official as having a very heavy termite infestation.

TABLE N1102.1.2
EQUIVALENT *U*-FACTORS^a

CLIMATE ZONE	FENESTRATION <i>U</i> -FACTOR	SKYLIGHT <i>U</i> -FACTOR	CEILING <i>U</i> -FACTOR	FRAME WALL <i>U</i> -FACTOR	MASS WALL <i>U</i> -FACTOR ^b	FLOOR <i>U</i> -FACTOR	BASEMENT WALL <i>U</i> -FACTOR	CRAWL SPACE WALL <i>U</i> -FACTOR
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	0.082	0.141	0.047	0.091 ^c	0.136
4 except Marine	0.35	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.34	0.55	0.026	0.06057	0.082	0.033	0.0597	0.065
6	0.34	0.55	0.026	0.06057	0.060	0.033	0.0597	0.065
7 and 8	0.35	0.60	0.026	0.057	0.057	0.033	0.059	0.065

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.

b. When more than half the insulation is on the interior, the mass wall *U*-factors shall be a maximum of 0.17 in zone 1, 0.14 in zone 2, 0.12 in zone 3, 0.10 in zone 4 except Marine and the same as the frame wall *U*-factor in Marine zone 4 and in zones 5 through 8.

c. Basement wall *U*-factor of 0.360 in warm-humid climates as defined by Figure N1 101.2 and Table N1101.2.

**TABLE N1102.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION (R-VALUE)**

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL EQUIVALENT R-VALUE ^a
Steel Truss Ceilings^a	
R-30	R-38 or R-30 + 3 or R-26 + 5
R-38	R-49 or R-38 + 3
R-49	R-38 + 5
Steel Joist Ceilings^b	
R-30	R-38 in 2 .4 or 2 .6 or 2 .8 R-49 in any framing
R-38	R-49 in 2.4 or 2.6 or 2.8 or 2.10
Steel Framed Wall	
R-13	R-13 + 5 or R15 + 4 or R-21 +3 or R-0 + 10
R-19	R-13 + 9 or R-19 + 8 or R-25 + 7
R-21	R-13 + 10 or R-19 + 9 or R-25 + 8
Steel Joist Floor	
R- 13	R-19 in 2 .6 R-19 + R-6 in 2.8 or 2.10
R- 19	R-19 + R-6 in 2 .6 R-19 + R-12 in 2.8 or 2.10

For SI: 1 inch = 25.4 mm.

a. Cavity insulation *R*-value is listed first, followed by continuous insulation *R*-value.

b. Insulation exceeding the height of the framing shall cover the framing.

N1102.2.9 Crawl space walls. As an alternative to insulating floors over crawl spaces, insulation of crawl space walls shall be permitted when the crawl space is not vented to the outside. Crawl space wall insulation shall be permanently fastened to the wall and extend downward from the floor to the finished *grade* level and then vertically and/or horizontally for at least an additional 24 inches (610mm). Exposed earth in unvented crawl space foundations shall be covered with a continuous Class I vapor retarder. All joints of the vapor retarder shall overlap by 6 inches (152 mm) and be sealed or taped. The edges of the vapor retarder shall extend at least 6 inches (152 mm) up the stem wall and shall be attached to the stem wall.

N1102.2.10 Masonry veneer. Insulation shall not be required on the horizontal portion of the foundation that supports a masonry veneer.

N1102.2.11 Thermally isolated sunroom insulation. The minimum ceiling insulation *R*-values shall be R- 19 in zones 1 through 4 and R-24 in zones 5 through 8. The minimum wall *R*-value shall be R- 13 in all zones. New wall(s) separating the sunroom from *conditioned space* shall meet the *building thermal envelope* requirements.

N1102.3 Fenestration.

N1102.3.1 U-factor. An area-weighted average of fenestration products shall be permitted to satisfy the *U*-factor requirements.

N1102.3.2 Glazed fenestration SHGC. An area-weighted average of fenestration products more than 50 percent glazed shall be permitted to satisfy the solar heat gain coefficient (SHGC) requirements.

N1102.3.3 Glazed fenestration exemption. Up to 1% of the building floor area ~~45 square feet (4.1 m²)~~ of glazed fenestration per *dwelling unit* shall be permitted to be exempt from *U*-factor and SHGC requirements in Section N1 102.1. This exemption shall not apply to the *U*-factor alternative approach in Section N1102.1.2 and the Total UA alternative in Section N1102.1.3.

N1102.3.4 Opaque door exemption. One side-hinged opaque door assembly up to 24 square feet (2.22 m²) in area is exempted from the *U*-factor requirement in Section N1 102.1.1. This exemption shall not apply to the *U*-factor alternative approach in Section N1 102.1.2 and the Total UA alternative in Section N1102.1.3.

N1102.3.5 Thermally isolated sunroom U-factor. For zones 4 through 8 the maximum fenestration *U*-factor shall be 0.50 and the maximum skylight *U*-factor shall be 0.75. New windows and doors separating the sunroom from *conditioned space* shall meet the *building thermal envelope* requirements.

N1102.3.6 Replacement fenestration. Where some or all of an existing fenestration unit is replaced with a new fenestration product, including sash and glazing, the replacement fenestration unit shall meet the applicable requirements for *U*-factor and solar heat gain coefficient (SHGC) in Table N1 102.1.

N1102.4 Air leakage.

N1102.4.1 Building thermal envelope. The *building thermal envelope* shall be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material.

1. All joints, seams and penetrations.
2. Site-built windows, doors and skylights.
3. Openings between window and door assemblies and their respective jambs and framing.
4. Utility penetrations.
5. Dropped ceilings or chases adjacent to the thermal envelope.
6. Knee walls.
7. Walls and ceilings separating the garage from *conditioned spaces*.
8. Behind tubs and showers on *exterior walls*.
9. Common walls between *dwelling units*.
10. Attic access openings.
11. Rim joists junction.
12. Other sources of infiltration.

N1102.4.2 Air sealing and insulation. Building envelope air tightness and insulation installation shall be demonstrated to comply with one of the following options given by Section N1102.4.2.1 or N1102.4.2.2.

N1102.4.2.1 Testing option. Tested air leakage is less than 7 ACH when tested with a blower door at a pressure of 50 pascals (0.007 psi). Testing shall occur after rough in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation and combustion appliances.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed;
2. Dampers shall be closed, but not sealed; including exhaust, intake, makeup air, back draft, and flue dampers;
3. Interior doors shall be open;
4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling system(s) shall be turned off;
6. HVAC ducts shall not be sealed; and
7. Supply and return registers shall not be sealed.

N1102.4.2.2 Visual inspection option. The items listed in Table N1 102.4.2, applicable to the method of construction, are field verified. Where required by the code official, an *approved* party independent from the installer of the insulation, shall inspect the air barrier and

insulation.

N1102.4.3 Fireplaces. New wood-burning fireplaces shall have gasketed doors and outdoor combustion air.

N1102.4.4 Fenestration air leakage. Windows, skylights and sliding glass doors shall have an air infiltration rate of no more than 0.3 cubic foot per minute per square foot [$1.5(\text{L/s})/\text{m}^2$], and swinging doors no more than 0.5 cubic foot per minute per square foot [$2.5(\text{L/s})/\text{m}^2$], when tested according to NFRC 400 or AAMA/WDMA/CSA 101/I.S.2/A440 by an accredited, independent laboratory, and listed and *labeled* by the manufacturer.

Exception: Site-built windows, skylights and doors.

N1102.4.5 Recessed lighting. Recessed luminaires installed in the *building thermal envelope* shall be sealed to limit air leakage between conditioned and unconditioned spaces. All recessed luminaires shall be IC-rated and *labeled* as meeting ASTM E 283 when tested at 1.57 psi (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the *conditioned space* to the ceiling cavity. All recessed luminaires shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.

SECTION N1103 SYSTEMS

N1103.1 Controls. At least one thermostat shall be installed for each separate heating and cooling system.

N1103.1.1 Programmable thermostat. Where the primary heating system is a forced air furnace, at least one thermostat per *dwelling unit* shall be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day. This thermostat shall include the capability to set back or temporarily operate the system to maintain zone temperatures down to 55°F (13°C) or up to 85°F (29°C). The thermostat shall initially be programmed with a heating temperature set point no higher than 70°F (21°C) and a cooling temperature set point no lower than 78°F (26°C).

N1103.1.2 Heat pump supplementary heat. Heat pumps having supplementary electric-resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load.

N1103.2 Ducts.

N1103.2.1 Insulation. Supply and return air ducts in attics and in unconditioned crawlspaces shall be insulated to a minimum of R-8. All other ducts shall be insulated to a minimum of R-6.

Exception: Ducts or portions thereof located completely inside the *building thermal envelope*.

N1103.2.2 Sealing. Ducts, air handlers, filter boxes and building cavities used as ducts shall be sealed. Joints and seams shall comply with Section M1601.4. Duct tightness shall be verified by either of the following:

1. Post-construction test: Leakage to outdoors shall be

less than or equal to 8 cfm (3.78 L/s) per 100 ft² (9.29

m²) of conditioned floor area or a total leakage less than or equal to 12 cfm (5.66 L/s) per 100 ft² (9.29 m²) of conditioned floor area when tested at a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler end closure. All register boots shall be taped or otherwise sealed during the test.

2. Rough-in test: Total leakage shall be less than or equal to 6 cfm (2.83 L/s) per 100 ft² (9.29 m²) of conditioned floor area when tested at a pressure differential of 0.1 inch w.g. (25 Pa) across the roughed in system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 4 cfm (1.89 L/s) per 100 ft² (9.29 m²) of conditioned floor area.

Exceptions: **1.** Duct tightness test is not required if the air handler and all ducts are located within *conditioned space*.

2. Duct tightness can be verified by sampling when approved by the code official.

N1103.2.3 Building cavities. Building framing cavities shall not be used as supply ducts.

N1103.2.3.4 Duct Design. Forced air heating and cooling equipment shall use the duct design procedures of ACCA manual D.

N1103.3 Mechanical system piping insulation. Mechanical system piping capable of carrying fluids above 105°F (40°C) or below 55°F (13°C) shall be insulated to a minimum of R-3.

N1103.4 Circulating hot water systems. All circulating service hot water piping shall be insulated to at least R-2. Circulating hot water systems shall include an automatic or *readily accessible* manual switch that can turn off the hot water circulating pump when the system is not in use.

N1103.5 Mechanical ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

TABLE N1102.4.2
AIR BARRIER AND INSULATION INSPECTION

COMPONENT	CRITERIA
Air barrier and thermal barrier	Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier are filled or repaired. Air-permeable insulation is not used as a sealing material.
Ceiling/attic	Air barrier in any dropped ceiling/soffit is substantially aligned with insulation and any gaps are sealed Attic access (except unvented attic), knee wall door, or drop down stair is sealed.
Walls	Corners and headers are insulated. Junction of foundation and sill plate is sealed.
Windows and doors	Space between window/door jambs and framing is sealed.
Rim joists	Rim joists are insulated and include an air barrier.
Floors (including above garage and cantilevered floors)	Insulation is installed to maintain permanent contact with underside of subfloor decking. Air barrier is installed at any exposed edge of floor.
Crawlspace walls	Insulation is permanently attached to walls. Exposed earth in unvented crawlspaces is covered with Class I vapor retarder with overlapping joints taped.
Shafts, penetrations	Duct shafts, utility penetrations, knee walls and flue shafts opening to exterior or unconditioned space are sealed.
Narrow cavities	Batts in narrow cavities are cut to fit, or narrow cavities are filled by sprayed/blown insulation.
Garage separation	Air sealing is provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures are airtight, IC rated and sealed to drywall. Exception—fixtures in conditioned space.
Plumbing and wiring	Insulation is placed between outside and pipes. Batt insulation is cut to fit around wiring and plumbing, or sprayed/blown insulation extends behind piping and wiring.
Shower/tub on exterior wall	Showers and tubs on exterior walls have insulation and an air barrier separating them from the exterior wall.
Electrical/phone box on exterior wall	Air barrier extends behind boxes or air sealed type boxes are installed.

Common wall	Air barrier is installed in common wall between dwelling units.
HVAC register boots	HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
Fireplace	Fireplace walls include an air barrier.

N1103.6 Equipment sizing. Heating and cooling *equipment* shall be sized as specified in Section M1401.3 using ACCA manual J to determine the loads, and ACCA manual S for system size selection.

N1103.7 Snow melt system controls. Snow- and ice-melting systems supplied through energy service to the building shall include automatic controls capable of shutting off the system when the pavement temperature is above 50°F (10°C) and no precipitation is falling and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40°F (5°C).

N1103.8 Pools. Pools shall be provided with energy conserving measures in accordance with Sections N1 103.8.1 through N1 103.8.3.

N1103.8.1 Pool heaters. All pool heaters shall be equipped with a *readily accessible* on-off switch to allow shutting off the heater without adjusting the thermostat setting. Pool heaters fired by natural gas or LPG shall not have continuously burning pilot lights.

N1103.8.2 Time switches. Time switches that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on swimming pool heaters and pumps.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Where pumps are required to operate solar- and waste-heat-recovery pool heating systems.

N1103.8.3 Pool covers. Heated pools shall be equipped with a vapor retardant pool cover on or at the water surface. Pools heated to more than 90°F (32°C) shall have a pool cover with a minimum insulation value of R-12.

Exception: Pools deriving over 60 percent of the energy for heating from site-recovered energy or solar energy source.

SECTION N1104 LIGHTING SYSTEMS

N1104.1 Lighting equipment. A minimum of 50 percent of the lamps in permanently installed lighting fixtures shall be *high-efficacy lamps*.

Exception: High-efficacy lamps are not required when the lighting system is designed with a maximum power allowance of 1.1 W/ft².

Table N1101.5(4)

ALL OCCUPANCIES:
SMALL BUSINESS COMPLIANCE TABLE
DEFAULT U-FACTORS FOR VERTICAL GLAZING

<u>Vertical Glazing Description</u>				<u>Frame Type</u>		
<u>Panes</u>	<u>Low-e¹</u>	<u>Spacer</u>	<u>Fill</u>	<u>Any Frame</u>	<u>Aluminum Thermal Break²</u>	<u>Wood / Vinyl Fiberglass</u>
<u>Double³</u>	<u>A</u>	<u>Any</u>	<u>Argon</u>	<u>0.48</u>	<u>0.41</u>	<u>0.32</u>
	<u>B</u>	<u>Any</u>	<u>Argon</u>	<u>0.46</u>	<u>0.39</u>	<u>0.30</u>
	<u>C</u>	<u>Any</u>	<u>Argon</u>	<u>0.44</u>	<u>0.37</u>	<u>0.28</u>
	<u>C</u>	<u>High Performance</u>	<u>Argon</u>	<u>0.42</u>	<u>0.35</u>	<u>Deemed to comply⁵</u>
<u>Triple⁴</u>	<u>A</u>	<u>Any</u>	<u>Air</u>	<u>0.50</u>	<u>0.44</u>	<u>0.26</u>
	<u>B</u>	<u>Any</u>	<u>Air</u>	<u>0.45</u>	<u>0.39</u>	<u>0.22</u>
	<u>C</u>	<u>Any</u>	<u>Air</u>	<u>0.41</u>	<u>0.34</u>	<u>0.20</u>
	<u>Any double low-e</u>	<u>Any</u>	<u>Air</u>	<u>0.35</u>	<u>0.32</u>	<u>0.18</u>

Footnotes to Table N1101.5(4)

1. Low-eA (emissivity) shall be 0.24 to 0.16

Low-eB (emissivity) shall be 0.15 to 0.08

Low-eC (emissivity) shall be 0.07 or less

2. Aluminum Thermal Break = An aluminum thermal break framed window shall incorporate the following minimum design characteristics:

- a) The thermal conductivity of the thermal break material shall be not more than 3.6 Btu-in/h/ft²/F°;
- b) The thermal break material must produce a gap in the frame material of not less than 0.210 inches; and,
- c) All metal framing members of the products exposed to interior and exterior air shall incorporate a thermal break meeting the criteria in a) and b) above.

3. A minimum air space of 0.375 inches between panes of glass is required for double glazing.

4. A minimum air space of 0.25 inches between panes of glass is required for triple glazing.

5. Deemed to comply glazing shall not be used for performance compliance.